FERTILIZERS AND YOUR LAKE

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This fertilizer brochure was prepared by volunteers and members of the Lake Cochituate Watershed Association. Major contributors were:

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THE MASSACHUSETTS CONGRESS OF LAKES AND PONDS ASSOCIATIONS, INC.

The Massachusetts Congress of Lakes and Ponds Associations, Inc. (MCOLAPA) is an active organization working to vigorously support legislation to clean up lakes and ponds in the Commonwealth. The Congress provides citizen leadership in designing efforts to curb pollution in Massachusetts waters.

In September of 1979, the newly formed state-wide Massachusetts Congress of Lakes and Ponds Association, Inc. held an annual meeting at Worcester Polytechnical Institute. During the meeting, an Executive Committee was elected and project priorities were determined.

The Massachusetts Congress of Lakes and Ponds Associations, Inc. has two purposes as stated in its by-laws:

(1) To perform all acts appropriate to a non-profit, scientific, literary, and educational organization dedicated to the promotion and development of environmental quality standards essential for satisfactory life styles and conditions in the natural community, and

(2) To preserve the aesthetic, recreational, and commercial values of lakes and properties through the maintenance and improvement of such environmental factors as watershed ecology, water quality, lake water levels, shoreline, woodland management, agricultural soils practices, recreational and residential building standards, and related influences, such as water and boating safety.

Membership in the Congress is welcome and viewed as essential in assuring that the water quality issues on lakes and ponds are addressed on a state-wide as well as an individual level. More detailed information on the Massachusetts Congress of Lakes and Ponds Associations, Inc. is available by contacting Mr. Carl Peterson, President, P.O. Box 312, Westminster, MA 01473.

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FERTILIZERS AND YOUR LAKE

This brochure was developed as a part of the Lake Cochituate "314" project to discuss problems associated with fertilizer use and misuse. We hope that this detailed discussion of fertilizers and your lake will arouse public awareness of this particular example of non-point source lake pollution. Topics include: water quality, eutrophication, effects of fertilizers, reasons for concern, economics of the situation, and alternatives to lawns.

THE HYDROLOGIC CYCLE AND WATER QUALITY

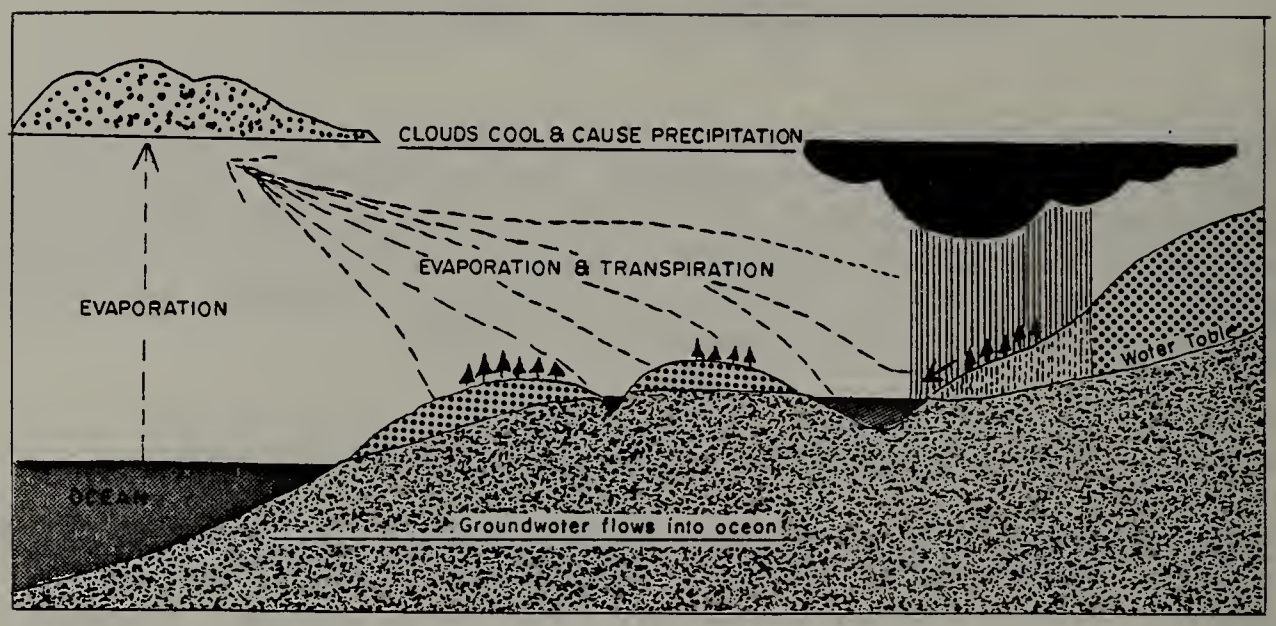
What does "water quality" mean? "Water quality" means different things to different people. Water may be cool or warm, "hard" (containing high concentrations of salts), clear or cloudy, acidic or alkaline. Water quality is thought of in terms of traits related to a specific use. Water quality must be associated with the intended use of water and can take on many different meanings. For example, the extremely cold water from the hypolimnion (i.e., the cold bottom layer of water) of Lake Cochituate's Middle Basin was considered perfect for use in Carling's heat exchange unit. However, water from the same source was judged inadequate for use as an ingredient in brewing their beer partly because the taste of the beer would be adversely affected. A carbonated beverage maker considered water of 50 ppm average weighted hardness (normally considered soft), satisfactory for use, whereas a rayon manufacturer considered the same water hard and unsatisfactory. Most of us, especially when washing clothes or dishes are interested in whether water is "hard" or "soft" for another reason. Hard water needs more soap than soft water to make a good lather. Hard water also roughens clothes and hands. Because of this, hard water can cost the average American family about $170 per year in shortened fabric life. Fortunately, New England has a very low water hardness rating: 0-60 ppm.

TABLE 1

PARTS PER MILLION	
0-60	soft
61-120	moderately hard
121-180	hard
More than 180	very hard

TABLE 1: The U.S. Geological Survey determines water hardness according to the above table. Parts per million refers to the amount of calcium carbonate or its equivalent that would remain if a volume of water was evaporated.

Water Quality is influenced by natural factors and by the activities of people. It is constantly moving between the earth and the atmosphere. This cycle of movement, the hydrologic cycle, takes place through evaporation and precipitation.

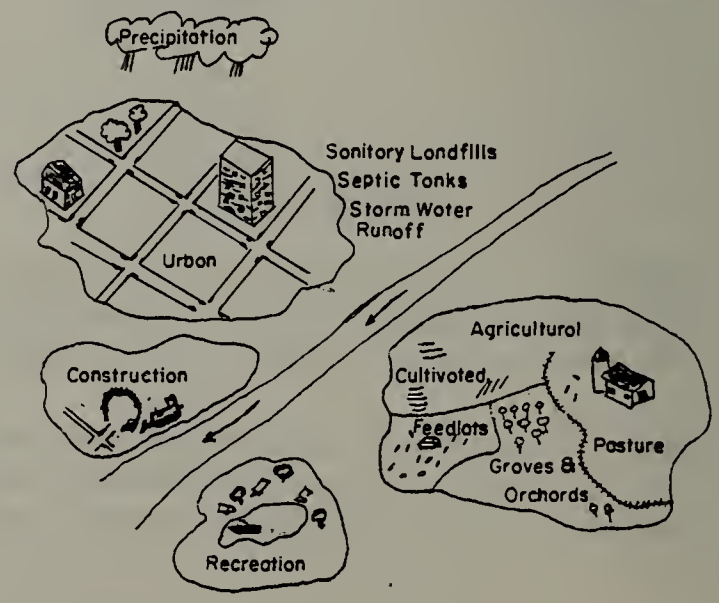


The Hydrologic Cycle

The heat of the sun evaporates water from oceans, lakes and reservoirs, from leaves on trees and plants, and from wet ground. The water vapor rises in columns of warm air over land. Upon rising, the warm, moist air mass cools. Water vapor condenses and precipitates as rain or snow. Once it falls to the earth it runs off into streams which in turn transport water to the ocean.

Natural factors, the season of the year, the climate, and the kinds of rocks and soil through which the water moves influence water quality. When rain falls, some water runs off into streams, some evaporates, some is used by plants for growth, and some sinks into the soil. Water that sinks into the soil dissolves minerals from the earth's crust and percolates through organic materials (roots, leaves, etc.). When rain reaches the water table, it becomes "groundwater." Groundwater quality is naturally affected by the length of time of contact and type of rocks and soils through which the water flows. Natural water quality is also altered by wind- and stream- transported sediments, and it is modified by water temperature, soil bacteria, and evaporation.

POINT SOURCE POLLUTION



NON-POINT SOURCE POLLUTION

Water becomes polluted from the way we use it...in our homes, factories, businesses, and farms. There are two basic sources of water pollution, "point" and "non-point". Point sources are "end of the pipe" discharges such as those from municipal sewage treatment plants, industries, and some concentrated animal feeding operations. Permits for this type of discharge are issued prescribing types and amount of pollutants that can be discharged into waterways.

"Non-point" source pollution is a much more difficult problem, caused by rainwater or surface runoff, that sweeps over the earth and enters the waterways. Examples of this type of pollution are: *Urban Storm Water*, water running off buildings and streets carrying with it oil, grease, trash, salts, lead, and other pollutants; *Construction Runoff*, earth washed into streams, rivers, and lakes from erosion; *Acid Mine Drainage*, water seeping through mined areas; *Forestry Runoff*, water washing sediments from areas where the earth has been disrupted by logging and timber operations; *Malfunctioning Septic Tanks*, *Poor Landfills*, *Underground Waste Areas*, where water seeps through the soils picking up pollutants and carrying them into waterways and groundwater, and *Agricultural Runoff*, rain washing fertilizers, pesticides, and topsoil into the water. Agricultural Runoff is the subject of this brochure. The non-point sources of pollution can best be reduced by greater care in the management of our water and land resources.

REASONS FOR CONCERN

We should value our water resources for many reasons. First and foremost, all living organisms contain water and depend upon it for survival. As our most precious substance, water has always been the major single controlling factor in the location of developed land. In the future, we can expect water supply and quality to affect the growth of populations. If water becomes polluted, the damage can spread over large areas, affecting the ecology of a region.

From our past record, we can see that people have polluted waters on a large scale, and at such an increasing rate that polluted water has both directly and indirectly become a serious threat to human health. Every day tremendous amounts of waste are disposed of from cities, industries, and agricultural operations into the water. Unfortunately, a high percentage of the discharges are poisonous. Pesticides, used by homeowner, farmer, and industry are a prime example of this problem. Pesticides usually enter the water in the same manner as fertilizers, chiefly via water runoff from treated areas. In the past, the municipalities and industries believed that waterways could indefinitely absorb, assimilate, dilute, and carry away incredible amounts of wastes. Today, as you look around you cannot help but notice the effects of pollution. It becomes painfully evident that the burden rests squarely on our shoulders to pay a debt that has steadily been accumulating for over a century.

Management of freshwater ecosystems is of fundamental importance for the maintenance of aquatic quality. Keeping waters clean and maintaining supplies of this natural resource is one of the most important conservation tasks that faces us today.

EUTROPHICATION

Eutrophication is the natural process of increasing nutrients in bodies of waters. This increase in nutrients leads to a subsequent increase in plant material in a lake. Natural eutrophication occurs in many lakes and marshes. Water bodies become shallower and gradually more fertile until they die, becoming bogs, fens, meadows, or cultivated land. Accelerated eutrophication can occur through the activities of human populations. This causes progressive broad

scale deterioration of water resources, through the introduction of excess nutrients into lakes and other water.

The water transport system of wastewater disposal can be regarded as the primary source of the eutrophication problems so apparent today. Actually, it is a roundabout way of dumping plant fertilizers into water. The process begins with the application of fertilizers rich in phosphorous and nitrogen to the soil replacing the quantities removed in the harvest of crops. The crops then serve as food for people leaving the body in the form of urine, feces, and carbon dioxide (exhaled air). The nutrients in urine and feces, mixed with water can flow into rivers, lakes, and estuaries where they act as fertilizers, amplifying the growth of aquatic plants.

Maintenance repair or replacement of inadequate septic systems will result in cleaner water. Excess nutrients in water bodies can also result from surface runoff as discussed in the following pages. The solution to this problem of human related eutrophication is obvious: simply cut down on the amount of nutrients entering our waters. Unfortunately, one of the earliest and still commonly used methods to control algae and aquatic weeds in water bodies is addition of chemicals (chiefly copper sulfate and aluminum sulfate) to inhibit plant growth. This symptomatic approach is like solving the problem of the leaky roof by placing a pan underneath to catch the drip. Chemical treatment of natural waters is potentially dangerous since the uncontrolled addition of toxic compounds can result in tragic side effects. Another somewhat less than satisfactory method of controlling eutrophication is the diversion of sewage waters to specially reserved site. Again, we are reminded that diversion is not a "cure".

Clearly, the primary objective in controlling eutrophication is to reduce the delivery of nutrients to bodies of water. Phosphorus and nitrogen are the two most important nutrients involved in excessive plant growth in lakes. Of all chemical elements required by plants, phosphorus is the most easily controlled.

CASE STUDY: LAKE COCHITUATE

Present data indicate that Lake Cochituate is a nitrogen-limited lake, meaning that nitrogen is the key nutrient controlling plant growth. Unlike phosphorus, nitrogen is not as readily retained by soil. Nitrogen leached from the soil of over-fertilized lawns and gardens can harm the water quality of any nearby water body. For every pound of nitrogen that seeps into the water supply of a lake or stream, over 700 pounds of weeds and algae can be produced. Lake Cochituate residents can help control the pollution of their lake by using fertilizers with low nitrogen content. All the major commercial fertilizers have three numbers on the package, such as 5-20-10. These numbers represent the percentages of nitrogen, phosphorus and potassium, respectively. Since Lake Cochituate is nitrogen-limited, the amount of nitrogen "nutrient load" entering the lake needs to be reduced. Therefore residents of the watershed should only buy fertilizers when necessary. If using fertilizer in this watershed the nitrogen number should be 5 or less. Remember also that several small fertilizer applications are better than one big application. Why? Once again, because nitrogen is not readily retained by the soil. In other words, with the first good rain the unused portion of nitrogen will go right through the soil with the rain into the groundwater and eventually to the nearest lake, pond, or stream. Fertilizing in the fall is also discouraged since 50 percent of it will flow into the lake in spring runoff. It is also a good idea to keep leaves and grass clippings out of streams.

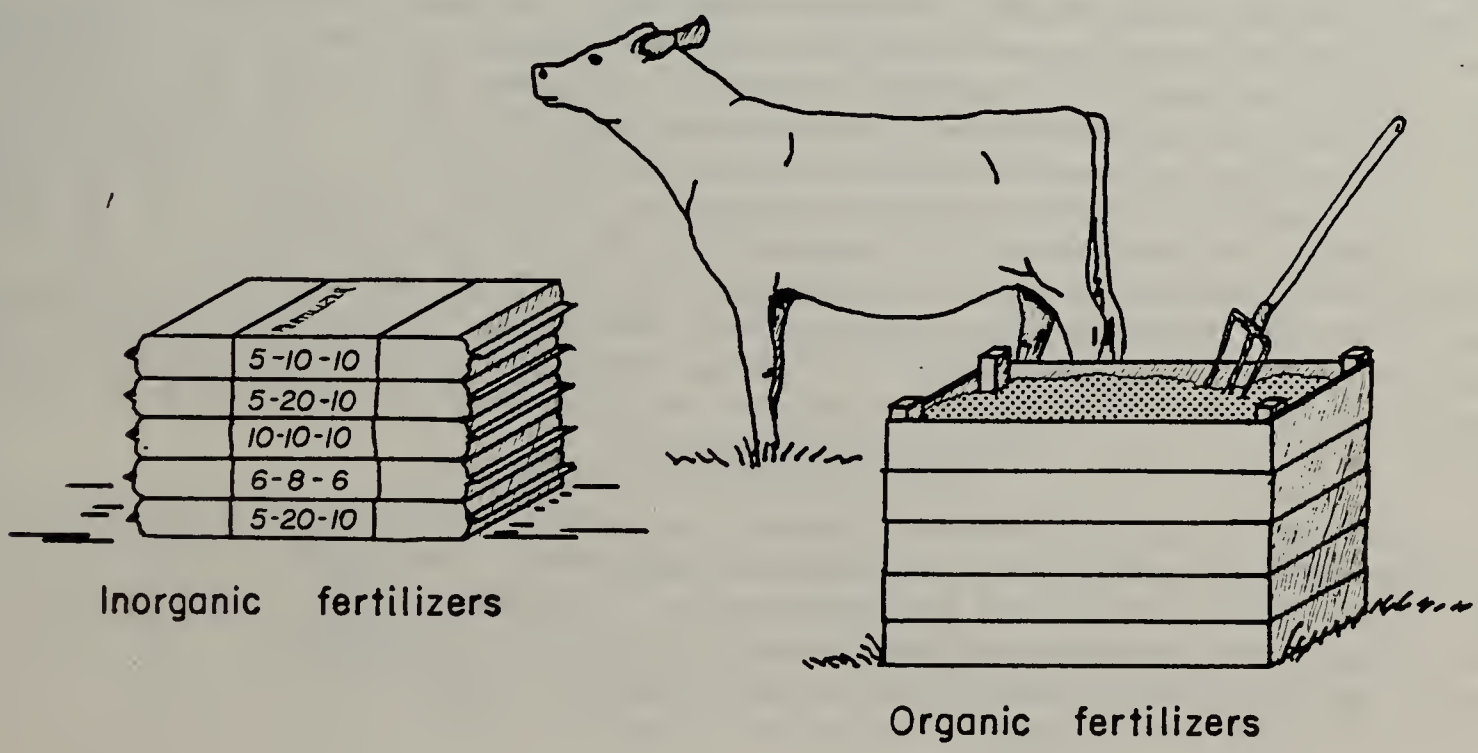
It will take a lot of effort to control plant growth problems in Lake Cochituate. Reclaiming a lake from impending doom of nitrogen pollution is no easy matter. The management of Lake Cochituate's eutrophication problems requires controlling the amounts of nitrogen and of iron, an essential trace element for certain blue-green algae and bacteria.

FERTILIZER

A fertilizer is any material which delivers required nutrients for increased plant growth, yield, quality, or nutritive value. The nutrients which almost all fertilizers contain are nitrogen, phosphorus and potassium, used in large quantities by all plants. Other nutrients may be present in trace quantities in some fertilizers.

Fertilizers are frequently thought of as artifically prepared materials containing plant nutrients. However, many excellent organic fertilizers, (animal manure, bonemeal, properly treated sewage sludge, and plant refuse) are normal by-products of our everyday life. These provide a slow-release, non-burning source of nutrients which have a long residual effect in the soil. They also provide humus, which improves the structure of the soil.

Inorganic fertilizers, on the other hand, are manufactured from diverse sources and are considerably more concentrated than organic fertilizers. They provide nutrient salts immediately - a desirable feature if the plant is showing symptoms of a deficiency, or where insect, pathological or physiological injury has occurred. The main disadvantage of inorganic fertilizers is that they are washed out of the soil ("leached-out") very quickly causing pollution problems. Inorganic fertilizers include ammonium nitrate, ammonium phosphate, potassium nitrate, and potassium chloride.



Inorganic fertilizers

Organic fertilizers

DYNAMICS OF FERTILIZER IN THE SOIL

Fertilizers increase the supply of available nutrients depleted from the soil. The nitrogen in fertilizers (nitrate form) is readily soluble in water and is rather quickly utilized by most crops. Nitrates are not fixed or held in the soil to any appreciable degree, therefore the nitrates are easily leached from the soil with rainfall or watering. They quickly travel to the groundwater and into lakes or streams, causing eutrophication. Organic fertilizers are advantageous to use because the nitrogen exists in the form of complex organic compounds which, for the most part, are insoluble in water. In order to be used by plants, these substances must first be broken down into simpler compounds, providing a slow release of nitrogen over the growing season. Remember that about 50 percent of the nitrogen added in *water soluble* form will be lost from the soil by leaching, erosion, and dentrification.

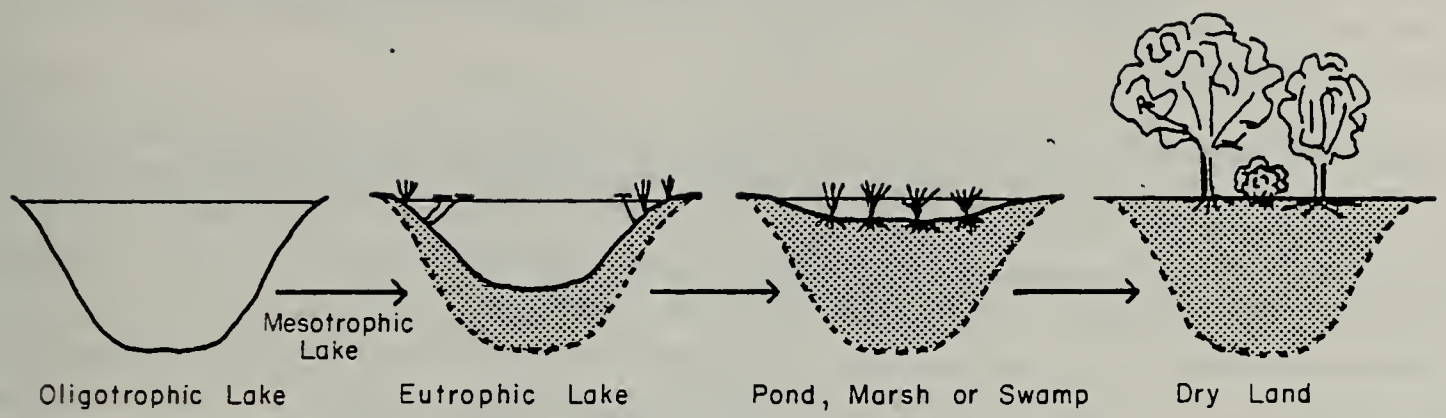
The amount of phosphorus removed from the soil every year usually exceeds the amount added to the soil in fertilizers, manures, and crop residues. In order to increase the amount of phosphorus in the soil, fertilizers containing this element are applied. Rock phosphate, bone meal, treated natural phosphates, basic slag, and chemical phosphates are the main sources of phosphorus in these compounds. If the soil is actively adsorbing phosphorus, and properly conducted phosphorus fertilizer applications are followed,phosphorus in waters from fertilizers should be minimal. However, the need to apply these fertilizers and the method of application must be carefully examined.

NUTRIENT EFFECTS IN THE LAKE

The enrichment of natural waters with nutrients induces a variety of biological and chemical changes in water quality, which can be viewed as beneficial or detrimental depending on the uses. The effects in terms of recreation, drinking water supply, and 'aesthetics' are unwanted, whereas effects on fish production may or may not be desirable, depending on the extent to which carp and other fish that thrive under eutrophic conditions are favored.

Excess nutrients, no matter what their source, are viewed as the main cause of eutrophication in water bodies. Though water-transport sewage disposal systems are the prime source of excess nutrients locally, fertilization is another major source. We put fertilizer on our gardens and lawns to increase the plant yield and quality. However, when the very same fertilizer enters our water bodies via surface runoff, groundwater seepage, and percolation to water tables or deep aquifers, they act upon the plants growing in the aquatic environment. The eutrophication process accelerates. The first obvious sign of this is a lowering of the aesthetic value of the lake through excessive growth of aquatic weeds and algae and the production of floating algal scums. The other common effects of increased nutrient supply in a lake include undesirable color, malodors, and foul taste of water, lowering the oxygen level in the lake, impairment of water treatment operations via the clogging of filters by algae, and an increase in the "trash" fish population.

You might be led to believe that there is a direct and exact relationship between rates at which fertilizers (nitrogen and phosphorus compounds) are supplied to the lakes and the resulting plant production. Generally, that is true. However, many factors influence the extent to which the nutrients of fertilizers become amplified into plant growth. Some of the factors are:



Stages in Eutrophication

1. amount of light available to green plants
2. concentrations and availability of nutrients
3. form and depth of water body
4. temperature
5. sedimentation of algae and nutrient-coated clays
6. removal of nutrients and algae in outflow water
7. consumption of plant food as it is produced
8. increased death of plants by disease
9. regeneration of nutrients from decomposition of plant and animal remains in water and in sediments (reutilization of former supply)
10. degree of mixing of lake water by wind

How do these nutrients actually get into the water? Generally, inorganic nitrogen is transported as nitrate by percolating waters. Some ammonium and nitrate carried in runoff waters may be highly significant in terms of the receiving water. Most of the phosphorus is transported in particulate form in runoff waters. The amount of dissolved phosphorus in runoff water may be of equal importance though lower in quantity. Runoff of these nutrients into water bodies is a natural process. If human activities lead to increasing the amounts of nutrients transported in agricultural drainage, then practices must be implemented to lessen nutrient influx, thereby helping to preserve the quality of our waters.

FERTILIZER REQUIREMENTS

Between 10 and 16 chemical elements are necessary for managed lawn growth. From a practical standpoint, the elements nitrogen, phosphorus, and potassium are the ones of major concern. Experience has shown that natural supplies of these elements are more likely to be insufficient than any of the others. Consequently, commercial fertilizers are based on supplying one or more of these elements. A fertilizer's content is expressed as a series of three numbers such as 8-6-2 or 10-10-10. The first number indicates the nitrogen content, the second number indicates phosphorus and the third indicates

potassium. It is customary to speak of fertilizers and fertilizer mixtures as containing nitrogen (N), phosphoric acid (P_2O_5) and potash (K_2O).

Years of testing Massachusetts lawn soil samples reveals that most lawns are managed through an application of fertilizer at what is called in Table 2, a 'standard application'.

Good lawn maintenance is also the best way to minimize transport of nutrients into the lake. Proper application (even distribution), timely application (when grass has most need of feeding), sufficient watering, and mowing at a proper height all are designed to maximize the percentage of nutrients getting to the grass and avoiding runoff as much as possible.

TABLE 2
STANDARD APPLICATION FOR LAWN FERTILIZERS

TYPE OF FERTILIZER	DATE OF APPLICATIONS AND POUNDS APPLIED PER 1,000 SQUARE FEET		
	APRIL 1	ABOUT MAY 15	ABOUT SEPTEMBER 1
20-10-5, 20-6-4* or similar analysis	5-7 lbs	4-5 lbs	4-5 lbs
10-6-4, 10-5-5* or similar analysis	10-12 lbs	6-8 lbs	6-8 lbs
8-6-4, 8-6-2 or similar analysis	15-20 lbs	10-15 lbs	10-15 lbs
Processed sewage or other organic waste	25-30 lbs	10-15 lbs	10-15 lbs

*Fertilizers containing at least 75 percent of the nitrogen as ureaform may be used at higher rates and one or two applications per season.

NOTE: Choose only one of the fertilizing schedules above for use during any one growing season.

From the Cooperative Extension Service - University of Massachusetts leaflet on LAWN MAINTENANCE.

Phosphorus is quickly and tightly bound to soil particles. Its availability to plants varies with many factors, but its tendency to form slowly soluble compounds tends to pretty much keep it in place as far as lawns are concerned.

Potassium is also to a large extent fixed by soil, depending on the size of the soil particles. When changed to various compounds, potassium moves slowly if at all in the soil and leaching is minimal.

Nitrogen is the most soluble of the three common fertilizer constituents. In the nitrate form it is easily leached from the soil. In *ammonia*, nitrogen is soluble in water but is not as readily leached because of the rather large quantities of ammonia which can be adsorbed and held by soil.

The amount and form of nitrogen in a fertilizer mixture is what largely determines the price that is paid for it. There are few bargains in complete fertilizers. Nitrogen is expensive to supply and the more of it that is present in the longer lasting forms (ammoniform or ureaform) the more expensive it is.

Organic fertilizer materials should be considered particularly advantageous for composting and home gardening. When worked into the soil, these composted materials provide an excellent medium for plant growth. In the early days of the fertilizer industry, animal byproducts provided much of the nitrogen; but now the higher grades of these byproducts are used in the manufacture of animal feeds. Cost now prohibits their use in the manufacture of fertilizers.

Pulverized and composted animal manures are good sources of organic matter but have a poor analysis for plant food usually testing something like 2-1-2 or 1-1-1. A large amount of such material would have to be used to properly feed a lawn.

Calcium is another element that is in short supply in most Massachusetts soils. It is easily supplied in ground limestone. This may be applied every two to four years in early spring or fall at the rate of 50-100 pounds per 1,000 square feet. Ground limestone not only supplies calcium but also adjusts our traditionally acidic soil toward the neutral level best for plant growth.

RAPID LEACHING OF FERTILIZER

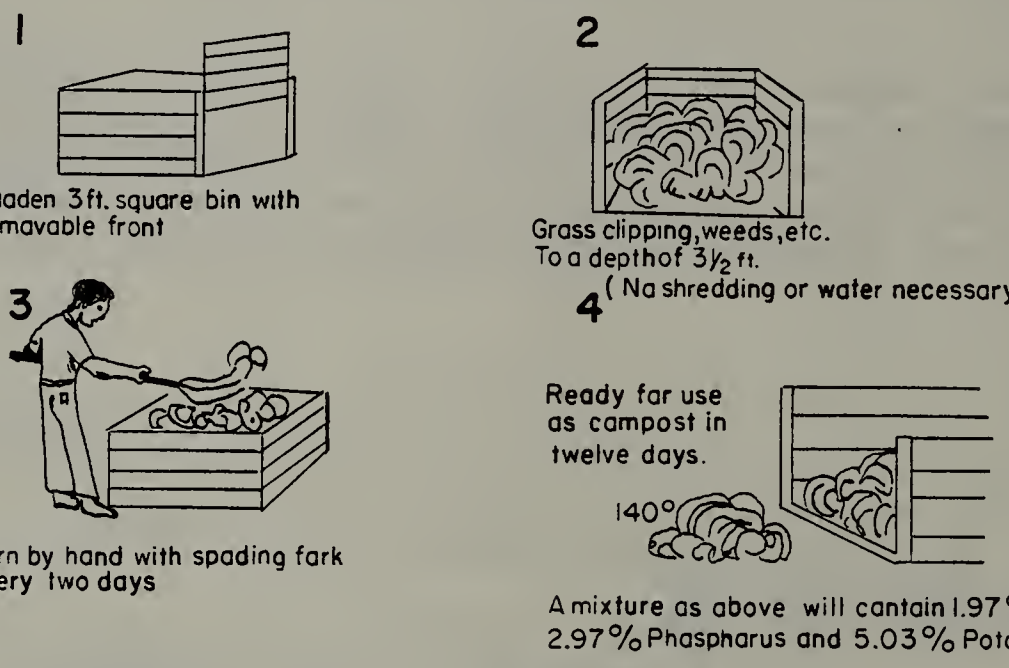
CHEMICAL FERTILIZER - In chemical fertilizers, some of the fertilizing elements are water soluble and are washed out when it rains. The fertilizer then goes into lakes and streams (also via groundwater) where instead of fertilizing grass etc., it fertilizes the algae. Result is an algae bloom, algae then clogs gills of fish,in addition to decreasing the oxygen in a lake, and the fish die of suffocation.

USING CHEMICAL FERTILIZER

If you use chemical fertilizer you should be careful to apply only as much as your lawn or plants need. More will just get washed away. You'll be wasting your money as well as polluting the water. You can find out how much of what kinds of fertilizer you need by taking a sample of your soil to the University of Massachusetts, or to your county extension office.

Even if you're using chemical fertilizer, you should try to put as much organic material into your soil as possible. The chemicals in the fertilizer stick to the particles of leaves and other rotted material much better than to sand so you will be holding much more of what you put on in your soil and less will be washing away. The organic materials will also help to keep your soil from packing down if it is clay, and will help sandy soil to hold more water. Because the organic material eventually rots away, you have to keep replacing it.

MAKE A COMPOST PILE — THE CALIFORNIA METHOD



To Make Compost: Select a site on your land which is shaded and sheltered from the wind. You can build an enclosure or just pile your leaves up. Wet the leaves as you pile them up and they'll not blow around - also they'll rot much faster. Add leftover vegetables and fruit rinds too. If you use oak leaves, add lime and fireplace ashes to neutralize the acid in the leaves and speed decomposition. If you leave your pile of leaves undisturbed it will take about a year to totally decompose. It takes longer for oak leaves. You can speed up the process by adding already rotted material, manure, grass clippings, garbage, etc. to the pile. Turning the contents of the pile also speeds up the process of rotting. Work the compost into your lawn or garden soil.

USING ORGANIC FERTILIZERS

Organic fertilizer is any kind of rotted or partially decomposed material which has nutrients in it which can be used by plants. Some minerals such as lime and granite dust are occasionally listed as organic fertilizers because they are natural sources of minerals.

Organic materials can be applied in quantity without harming the plants and without causing excessive pollution; however, they are very bulky for the fertilizer power provided.

If you are now using peat moss, bark mulch, cocoa hulls, peanut hulls, or any other similar material, you are using organic fertilizer. Even if you use these materials only for their esthetic appeal, they decompose, slowly releasing their nutrients for your shrubs to use.

PESTICIDES AND OTHER POISONS

WARNING: Pesticides are poisonous. Compounds should not be used unless specifically recommended by University or County personnel. Pesticides should only be used according to manufacturers directions. Read and follow all safety precautions on the label.

Use of pesticides on lawn is usually not cost effective. Regular cutting with a fairly high blade keeps a healthy mixture of grasses. Insects and fungi are rarely a problem at this latitude.

It is very important that pesticides and fertilizers be applied only where they are necessary and kept off driveways, pavements, and other areas where they may be easily washed away. Care should be used in washing, rinsing, or disposing of containers or utensils used in application so that excess material does not contaminate the environment.

SLOW LEACHING OF FERTILIZER

The fertilizing elements in organic materials are "locked up" in unrotted pieces of material. Bacterial action allows the fertilizing elements to be released slowly. The plants use it up as it is released, so very little gets into streams and lakes. The algae are kept under control because there is not an excess of fertilizers in the water. Fish have an abundant supply of oxygen.

Herbicides: Some homeowners treat their lawns with one or more compounds to control broadleaf weeds such as dandelions, plantain, or chickweed. Control is often accomplished only with a mixture of compounds since more than one kind of weed may be present. Much care should be taken when using these materials or desirable plants and shrubs may be injured through airborne drifting of the material. Time of year, time of day, wind, and temperature are all important when using any herbicide.

The Environmental Protection Agency in February of 1979, restricted the herbicides 2, 4, 5-T and Silvex and prohibited them from being made available to homeowners. These herbicides contain an impurity; dioxin, which is extremely hazardous. Existing supplies should be safely disposed of in hazardous waste disposal facilities or returned to the distributor.
The herbicide 2, 4-D is acceptable for removal of poison ivy, if absolutely warranted. Mecoprop is currently marketed as a herbicide. Unwanted crabgrass is best controlled by managing the height of the grass.

Some herbicides, particularly those used as soil sterilants, are quite persistent. These are seldom, if ever, recommended in lawn care. They are more likely to be used in agricultural situations.

Another group of chemicals often applied to lawns are the pre-emergence materials, such as Dacthal, used to control crabgrass. These compounds have a very low solubility in water. They are not readily leached through our common lawn soils, however, Dacthal has been found to contain a toxic impurity.

Insecticides: At the present time, the University of Massachusetts and the County Extension Agents are, except in rare instances, only recommending two materials for the control of lawn insects (Japanese beetles, chinch bugs, European chafers, etc.). These two compounds are diazinon and chlorpyrifos (Dursban). These are both biodegradable and on degradation may yield a small amount of phosphorus. However, a proper rate of application (2-6 lbs per acre) is such that these should not become a factor in adding to the lake's phosphorus levels.

In some instances there are nonpoisonous methods which can be used to control insects. For example the Japanese beetle can be killed by infection with milky spore disease. This product is marketed under several trade names.

Fungicides: Fungus disease of lawn grasses while not uncommon are usually left untreated. The application of sulfur, lime, and copper sulfate to control fungus diseases (especially in grains and grapes) began over 100 years ago. In the last 30 years a large number of synthetic fungicides have gradually supplanted sulfur and copper. Certain of these, notably Captan and Dinocap, can be harmful to fish. However, Dacthal has been found to contain a toxic impurity. These are not ordinarily recommended for lawn use. Captan has been identified as a suspected carcinogen. It is unsafe for children to be exposed to Captan. Most of the new synthetic fungicides are highly efficient and can be used without harm due to low toxicity, as many show a greater safety factor than copper, and because many of them are bio-degradable.

Application of fungicides should only occur when a specific problem has been properly identified and a specific compound has been recommended by professionals.

*NOTICE: If a trade name is used in this publication for identification, no product endorsement is implied, nor is discrimination intended against similar materials.

ALTERNATIVES TO LAWNS

NATURALISTIC LANDSCAPING:

WHAT EXACTLY IS NATURALISTIC LANDSCAPING?

The concept involves reducing the size of your lawn, or eliminating it completely. Put in its place an imaginatively arranged array of native trees, shrubs, or old field grasses and wildflowers. As they're native, they should offer little difficulty in cultivation. If your lawn is left to grow,wildflowers will abound. If you have not been using herbicides, up to 40 other associated species will also appear. Suppress unwanted woody growth by pulling up the woody seedlings while the soil is moist. By using plantings in the proper places as shrub and tree borders, you may not only reduce lawn size, but also increase your privacy. The "screen plantings" most effective in the northeast include: hemlock, red cedar, and white pine mixed with mountain laurel or rhododendrons.

If you live in a wooded setting, let nature work for you. Permit the natural woodland vegetation to dominate. Remember, falling leaf litter forms a self-maintaining, recycling ground cover. The whole system is solar-subsidized and self-perpetuating.

ADVANTAGES OF NATURALISTIC LANDSCAPING

Naturalistic landscaping can reduce the irksome chores of lawn mowing, fertilizing, weeding, and watering, while providing handsome home lots and saving energy too! It has recently been proven that techniques in naturalistic landscaping have significant relevance in conserving millions of gallons of our petroleum supply, saving thousands of tons of fertilizer, and negating the unnecessary use of pesticides. On the average, each year Americans use three million tons of fertilizer on five million acres of lawn. With phosphorus, a vital element and major component of fertilizer, in short supply in the near future, you can see just one of the many reasons why concern has been voiced on the issue.

Let's sidestep those negative environmental impacts of intensive lawn maintenance. Stop using the three million tons (15 percent) of the fertilizers produced that keep American lawns greener than necessary. Put away those noisy power mowers that consume more than 200 million gallons of gasoline per year. A smaller lawn in conjunction with naturalistic landscaping is a viable alternative on which a hand mower can be used. This not only will provide beautiful grounds, but offers the homeowner exercise, too, besides cutting down on the increased use of fertilizers, pesticides, and herbicides in our environment. No doubt, it's a bold challenge to your lifestyle. However, if these changes increase the enjoyment of your home, while moving toward a more environmentally sound manner of managing your grounds, then benefits will be shared by family and society alike.

Tasteful planting of groundcovers, perennials and shrubbery
can be a successful LAWN ALTERNATIVE

SOURCES

Put Your Mower in Moth Balls, William A. Niering, Connecticut College Alumni Mag. (Winter 1977)

Connecticut Arboretum Bulletins No. 21 and No. 14

1. Energy Conservation on the Home Grounds;

   The Role of Naturalistic Landscaping
   By: William A. Neiring and Richard H. Goodwin

2. Creating New Landscapes with Herbicides;

   A Homeowner's Guide
   By: William A. Niering and Richard H. Goodwin

THE LAKE COCHITUATE 314 PROJECT

Lake Cochituate is widely recognized as one of the most important recreational lakes in Massachusetts. Less well known is the fact that the quality of its water has been steadily decreasing due to complex series of causes. In order to reverse this deterioration, the Massachusetts Department of Environmental Quality Engineering applied for and received from the U.S. Environmental Protection Agency a grant (under Section 314 of Public Law 92-500) to examine the feasibility of, and construct where justified, a variety of innovative projects designed to decrease the amount of nutrients entering the lake. Nutrient reduction would hopefully lead to a decrease or elimination of the unpleasant algae growth that occur in late summer and early fall.

If shown to be environmentally sound and cost effective in decreasing nutrients, engineering solutions would be implemented at three of the lake's tributaries: Pegan Brook, Snake Brook, and Beaver Dam Brook.

Aware that the above three activities can deal with only a portion of the problem, the DEQE decided to contract with the Lake Cochituate Watershed Association to carry out a citizen awareness campaign. The campaign was aimed at informing individuals living within the Watershed, particularly in the Course Brook and Snake Brook basins, of activities that produce excessive nutrients, and to help citizens learn how they can decrease amounts of nutrients through individual actions. This brochure was a major part of that effort. Others deal with phosphates washing detergents and septic system problems.

Thanks to the support of local industry and commerce, state and local water pollution control and health agencies, and to the tireless energy of its many volunteer members, its efforts have led to the successful reduction of levels of hazardous pollutants, oils, acids, and algae fertilizing nitrates and phosphates entering the lake.